Agricultural Research Service
United States Department of Agriculture

National Sedimentation Laboratory

Oxford, Mississippi 38655

EVALUATION OF THE COLDWATER RIVER

January, 1989 through June, 1991

Interim Report
for
The Demonstration Erosion Control (DEC) Task Force

Prepared By:
C. M. Cooper, P. G. McCoy, and S. S. Knight
Water Quality/Ecology & Watershed Processes Research Units

National Sedimentation Laboratory Research Report No. 1

SEPTEMBER 1992

Oxford, Mississippi 38655

EVALUATION OF THE COLDWATER RIVER

January, 1989 through June, 1991

Interim Report
for
The Demonstration Erosion Control (DEC) Task Force

Prepared By:
C. M. Cooper, P. G. McCoy, and S. S. Knight
Water Quality/Ecology & Watershed Processes Research Units

National Sedimentation Laboratory Research Report No. 1

SEPTEMBER 1992

EVALUATION OF THE COLDWATER RIVER

Interim Report

JANUARY, 1989 THROUGH JUNE, 1991[1]

for

The Demonstration Erosion Control (DEC) Task Force

by

Water Quality/Ecology & Watershed Processes Units
National Sedimentation Laboratory
Agricultural Research Service
U. S. Department of Agriculture
Oxford, Mississippi

Personnel
C. M. Cooper, P. G. McCoy, and S. S. Knight[2]

---

[1] Contribution of the National Sedimentation Laboratory, Agricultural Research Service, U. S. Department of Agriculture, Oxford, Mississippi in cooperation with the U. S. Army Corps of Engineers, Vicksburg District.

[2] Ecologist, Biologist, and Ecologist, National Sedimentation Laboratory, Oxford, Mississippi.

TABLE OF CONTENTS

EVALUATION OF THE COLDWATER RIVER

January 1989 through June, 1991

EXECUTIVE SUMMARY

Statement of Purpose

As part of the Demonstration Erosion Control Project in the Yazoo Basin (DEC), the Water Quality and Ecology Research Unit at the USDA National Sedimentation Laboratory was requested by the Corps of Engineers, Vicksburg District, to evaluate the current environmental status of the Coldwater River in Northern Mississippi for a two-year period before DEC construction activities began. The Demonstration Erosion Control Project in the Yazoo Basin is a cooperative interagency project aimed at flood control and reducing erosion and channel instability. Additional goals of DEC include demonstration of innovative management techniques, total watershed planning, and water quality and environmental enhancement. General objectives for the Coldwater River project included determining (1) pre-project water quality in the main channel and tributaries, (2) major pre-project ecosystem integrity for evaluation of change during project, (3) if the wetland corridor bordering the main channel of the upper Coldwater is/is not environmentally sensitive and valuable as a "natural" area, (4) if the wetland is/is not sustaining damage from surrounding land usage, and (5) if DEC erosion/sedimentation control techniques are necessary to protect environmentally sensitive areas and reduce downstream damages.

Evaluation

Following initial ground and aerial surveys of the Coldwater System that allowed us to determine an appropriate approach for our evaluation, the Water Quality and Ecology Research (WQER) Unit chose a three-pronged research approach.

1. Water Quality --

We established 8 original sampling sites on the Coldwater River and its major tributaries in January, 1989 (Fig. 1; sites 7-1 through 7-8). Four additional sites (X-1 through X-4) were added in January, 1991, with 3 sites on Pigeon Roost Creek and 1 on Cuffawa Creek. Pesticide samples were taken quarterly for both baseline and storm event coverage when possible. Routine weekly/biweekly water samples were tested for the following parameters: **dissolved oxygen, pH, temperature, conductivity, nitrate, total phosphorus, ortho-phosphorus, ammonia, and total, suspended and dissolved sediments. Coliform and Enterococci colony counts** were begun in June, 1991. Procedures are performed according to standard water quality methods (APHA, 1989). This sampling frequency has allowed us to establish pre-construction water quality trends for the Coldwater River system for comparisons after protection efforts are implemented.

2. Flora Surveys --

Plant transects were established in 8 locations and sampled extensively from the fall of 1989 through the fall of 1990. Transect sites were selected so that all major habitat types observed during ground and aerial reconnaissance were sampled. General collections were also made in areas not included in the transects.

3. Fauna Surveys --

Fish collection sites corresponded to plant transect sites so that all major habitat types were sampled. Fish collections are currently being made with a variety of gear to reduce sampling bias. Qualitative fish sampling will continue to provide a relatively comprehensive species list and include any fishes which are rare, endangered, and/or of special concern that may inhabit the Coldwater River system. These collections should also provide an index of stock abundance and form the basis of an Index of Biotic Integrity. General qualitative sampling of macroinvertebrates will also continue to be made.

INTERIM RESULTS

1. ***Land Use***

- Twenty-six percent of the watershed was in cropland (56% soybeans and 18% cotton), 20% in pasture, and 39% in forest. The other 15% was idle land, roads, urban, and other uses.

- Forty-one percent of the forest was in alluvial plain.

2. ***Water Quality***

- Natural stream sections had consistently lower concentrations of suspended sediments. They also exhibited dampened, delayed reactions to storm flows because of stream-flood plain interaction.

- Channelized streams with direct runoff and no riparian zones were consistently higher in nutrient concentrations than natural channel reaches.

- Pesticides which are currently in use and residual organochlorine insecticides were detected in less than 10% of quarterly pesticide samples from all major streams in the Coldwater Basin.

- Arsenic was detected in over 50% of quarterly contaminant samples.

3. ***Plant Surveys***

- Wetland habitat types along the Coldwater River were surveyed for their plant diversity. Approximately 289 species were identified from 3162 plant specimens, indicating the intrinsic wetland value of the Coldwater River flood plain.

4. ***Faunal Surveys***

- Representatives of 37 species of fish have been collected in this continuing study.

ACKNOWLEDGEMENTS

This report was prepared as a part of the Technology Application Project (TAP) of the Agricultural Research Service at the National Sedimentation Laboratory, Oxford, Mississippi. Research was accomplished in cooperation with the Demonstration Erosion Control (DEC) Project in the Yazoo Basin. Partial funding was received from the Corps of Engineers, Vicksburg District. Technical assistance on land use was provided by E. R. VonKohn of the Mississippi Soil Conservation Service, a DEC participant. Pesticide analyses were performed by the staff of the Soil-Plant Analysis Laboratory at Northeast Louisiana University, Monroe, Louisiana, under the guidance of Director Debbie Brotherton. Dr. M. B. Huneycutt, Professor Emeritus of Biology, University of Mississippi provided botanical expertise. The authors wish to thank these people and the following ARS personnel: Samuel Testa, Terry Welch, Betty Hall, and Robert Holley.

INTRODUCTION

This interim report concerns research and evaluation of stream water quality and ecology in the 607 sq. mi. Coldwater River Basin of north central Mississippi. The Coldwater River drainage in the uplands of Mississippi has been designated as part of the Demonstration Erosion Control (DEC) Project in the Yazoo Basin. This Project is a federal interagency project with contributions by the Corps of Engineers, the Soil Conservation Service, and the Agricultural Research Service. The Coldwater River catchment is in a natural condition with a meandering channel bordered by wetlands. All major tributaries have incised channels that have been subjected in the past to dredging and straightening for flood control. The overall objective of the present research is to evaluate watershed stream conditions prior to a major construction effort.

STUDY SITE

The Coldwater River system, prior to flowing into Arkabutla Reservoir, extends across northern Mississippi from Benton County through Marshall, DeSoto, and Tate counties. The study area encompasses all drainage from north of Holly Springs, Mississippi, to Arkabutla Reservoir southeast of Hernando, Mississippi. Total acreage for this section of the Coldwater River drainage area is 388,360 acres with 102,777 acres in cropland, 78,596 acres in pasture, 26,050 acres in native woods/scrub, and 153,924 acres in hardwood forests. Idle land and other uses accounted for 27,013 acres. Major tributaries studied and their corresponding drainage area acreages include: Camp Creek Canal-41,400 acres, Byhalia Creek-27,060 acres, Short Fork Creek-10,800 acres, Pigeon Roost Creek-151,200 acres, and Big and Little Jordan Creeks-12,300 acres.

Following ground and aerial reconnaissance, 8 original water quality sampling sites were established on the Coldwater River and its major tributaries. These sites were designated as 7-1 through 7-8, proceeding from most downstream to most upstream site (Fig. 1). Four additional sites designated as X-1 through X-4 were added in January, 1991. Three are located on Pigeon Roost Creek and 1 on Cuffawa Creek, a major tributary of Pigeon Roost Creek. Additionally, plant transects were established in 8 locations distributed over the length of the drainage so that all major habitat types were sampled. Fish, invertebrate, and non-fish vertebrate collection sites roughly correspond to the plant transects.

MATERIALS AND METHODS

Water quality samples were taken weekly from January, 1989 until July, 1991, at which time sampling frequency was reduced to biweekly. Water samples were analyzed for **ortho-phosphorus, total phosphorus, nitrate, ammonia, chlorophyll, dissolved oxygen, conductivity, pH, temperature, total solids, dissolved solids, and suspended solids**. All analyses were performed according to standard methods

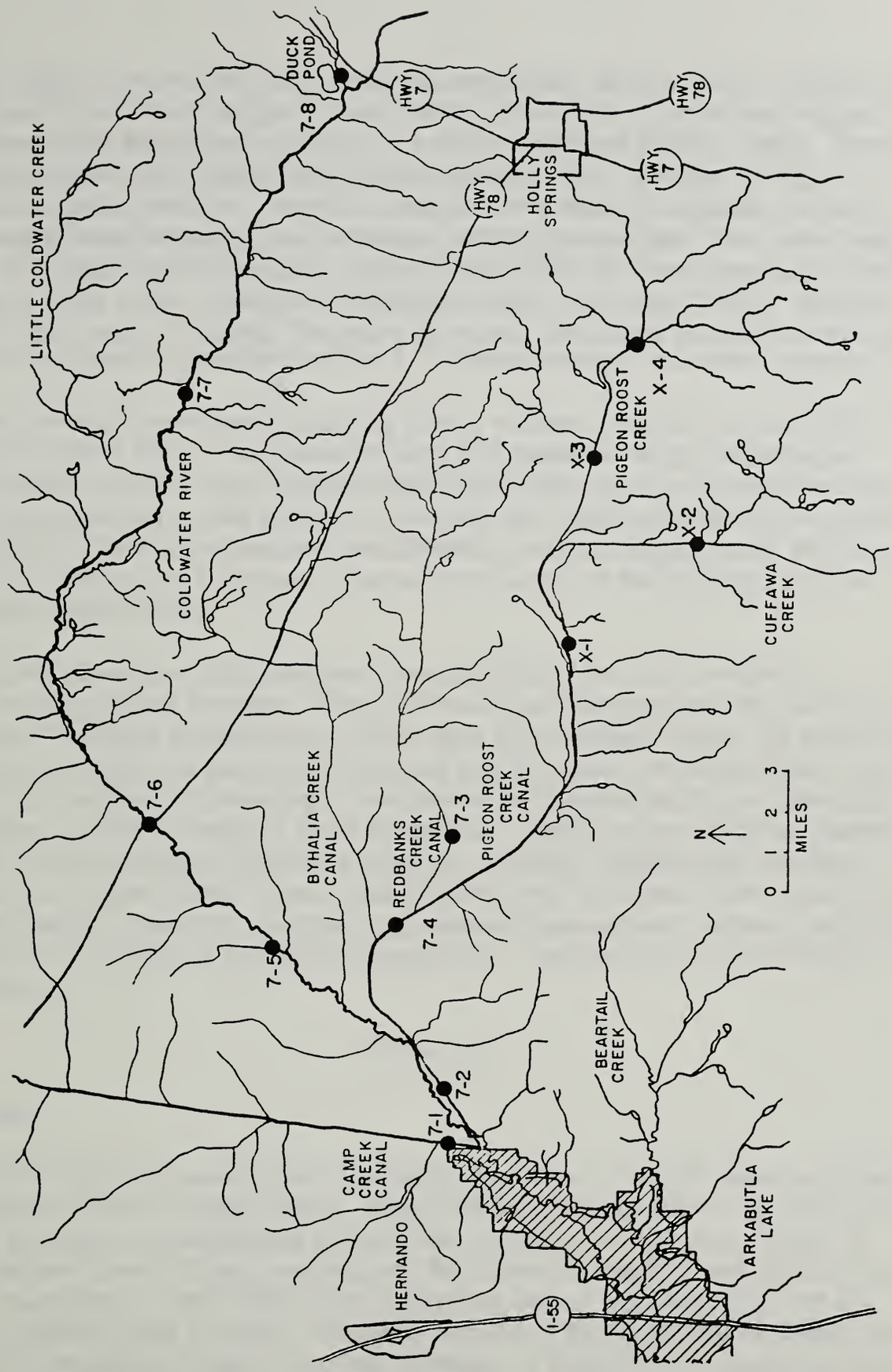


Fig. 1 Water Quality Sampling Sites for the Coldwater River Drainage Systems.

(APHA, 1989). Percent recovery of controls range from 95% to 100%. Coliform and Enterococci counts were begun in June, 1991, and are still in preliminary stages. The counts were also performed according to standard methods (APHA, 1989). Baseline pesticide samples were taken quarterly and included storm samples during winter-spring rainy seasons. Pesticide samples were taken in specially prepared acetone-and-hexane rinsed glass containers with teflon-lined lids. They were analyzed by gas and liquid chromatography using methods similar to those reported in detail by Smith and Willis (1987), Gehigand Fitzpatrick (1989), and Holak (1989). Minimum detection limit was 0.01 μg/kg. Recovery of internal standards was 90 to 100% using analytical procedures described by the U. S. Environmental Protection Agency (1971).

Plant transects were sampled during spring, summer, and fall from the fall of 1989 through the fall of 1990. The transects were 100 meters in length beginning at approximately mid-river and stretching inland past either bank perpendicular to the river. Plant specimens were pressed in the field and returned to the lab for species identification. Plant collections and identifications were performed under the direction of Dr. M B. Huneycutt, Professor Emeritus and Curator of the Herbarium of the University of Mississippi.

Faunal surveys are still in progress, with collection sites approximately corresponding to plant transects. Fish collections are being made with a variety of gear types to reduce sampling bias. These gear types include seines, gill nets, hoop nets, minnow traps, slat traps, boat-mounted and back-pack electroshockers, and rotenone. In addition to providing a comprehensive species list, these collections should also provide an index of stock abundance. Collection and analysis methods are based on those outlined in Nielsen and Johnson (1983). Additionally, non-fish vertebrate and invertebrate communities inhabiting the Coldwater River watershed are being incidentally collected. Targeted organisms include aquatic reptiles, amphibians, mollusks, and arthropods (including crustaceans). Results will be forthcoming in a later report.

RESULTS

Land Use

Of the 388,360 acres in the Coldwater River basin, 145,600 acres are directly in the drainage of the Coldwater River. Pigeon Roost Creek contains 151,200 acres and each of the other subwatersheds contain from 10,000 to 41,000 acres (Table 1). Preliminary estimates of land use acquired from Landsat imagery and detailed ground truth showed that, in 1987, 26% of the watershed was in cropland, 20% was in pasture, and 39% was in forest. Forty-one percent of the forest was in alluvial plains. The Soil Conservation Service acquired estimates of specific crop acreage in the fall of 1990. The estimates showed soybeans occupying 56% of crop land, cotton occupying 18% and wheat, corn and milo occupying smaller percentages.

Table 1. ***1990 Land usage in the Coldwater River drainage area (in acres).***

1. *Coldwater River* (direct drainage)

cotton	7,362	total crops*	39,604
soybeans	22,261	total woods	54,556
wheat	7,446	total acres	145,600
corn & milo	2,535		
pasture	28,800		
idle	9,682		
hardwoods	23,733		
upland forest	30,823		

2. *Camp Creek*

cotton	2,415	total crops	12,991
soybeans	7,302	total woods	12,581
wheat	2,442	total acres	41,400
corn & milo	832		
pasture	9,443		
idle	3,900		
hardwoods	7,311		
upland forest	5,270		

3. *Byhalia Creek*

cotton	978	total crops	5,260
soybeans	2,956	total woods	10,180
wheat	989	total acres	27,060
corn & milo	337		
pasture	7,341		
idle	2,246		
hardwoods	2,703		
uplands forest	7,477		

4. *Short Fork Creek*

cotton	630	total crops	3,389
soybeans	1,905	total woods	3,282
wheat	637	total acres	10,800
corn & milo	217		
pasture	2,463		
idle	1,017		
hardwoods	1,907		
upland forest	1,375		

* Total crops reflect the possible double-cropping of wheat and soybeans.

Table 1. (Continued) ***1990 Land usage in the Coldwater River drainage area.***

5. *Pigeon Roost Creek*

cotton	6,990	total crops	37,603
soybeans	21,137	total woods	69,960
wheat	7,069	total acres	151,200
corn & milo	2,407		
pasture	27,140		
idle	8,300		
hardwoods	26,233		
upland forest	43,727		

6. *Big & Little Jordan Creeks*

cotton	730	total crops	3,930
soybeans	2,209	total woods	3,365
wheat	739	total acres	12,300
corn & milo	252		
pasture	3,409		
idle	905		
hardwoods	1,455		
upland forest	1,910		

TOTAL ACRES

Total acreage	388,360
Total cropland	102,777
cotton	19,105
soybeans	57,770
wheat	19,322
corn & milo	6,580
Total pasture	78,596
Total idle	26,050
Total woods (hardwoods)	153,924
hardwoods	63,342
upland forest	90,582

Water Quality

Physical Parameters.--Mean, minimum and maximum values for physical water quality parameters are listed in Table 2. Channelized tributaries were warmer than natural reaches with riparian vegetation, but maximum **temperatures** were not excessive. **Conductivity** was much higher in Camp Creek Canal than at any other site. **PH** varied little across all sites. Only 1 site (Fig. 2) had problems with low **dissolved oxygen**. This site (7-8) is positioned in a wetland, and had naturally high oxygen uptake because of the large amount of organic material associated with it.

Specific comparisons were made between natural sites and channelized sites. Conductivity was higher at channelized sites (Fig. 3), but there was little overall difference in dissolved oxygen and pH. When sites were analyzed by month, some minor seasonal differences were noted (Fig. 4). Major site to site differences were noted in maximum **suspended solids** measurements (Fig. 5). As indicated by mean/maximum comparisons, the high values resulted from suspended sediments in storm flows. Camp Creek Canal and Cuffawa Creek had the highest concentrations of suspended sediments. Figure 5 also shows that suspended sediments increased in upper Pigeon Roost Creek proceeding from upstream to downstream (Sites X-4, X-3, X-1, 7-4, 7-2) with major contributing tributaries (Sites X-2 and 7-3). Average monthly suspended solids (Fig. 6) showed winter-spring wet season increases at both natural and channelized stream sites. However, natural sites had consistently lower values and delayed responses to storm flows as is typical of rivers with stream-floodplain interactions.

Nutrients.--**Phosphorus** and **nitrogen** varied with subwatershed land use and stream habitat. Channelized streams with direct runoff and no riparian zones were consistently higher in nutrient concentrations than natural channel reaches (Table 3). Nutrient concentrations responded to wet season runoff from cropland and pasture and to spring crop fertilization (Fig. 7). Total phosphorus, much of which is attached to sediments, responded to runoff similarly to suspended sediments.

Pesticides.--Seasonal monitoring of the Coldwater River drainage system for pesticides has been underway since January, 1989. Baseflow water samples are taken quarterly, with at least one storm event sample collected when possible to contrast runoff effects from agricultural land. These samples are screened for the following pesticides and commercial compounds: **Arsenic, Mercury, DDE, DDD, DDT, Methyl Parathion, Ambush, Basagran, Trifluralin, Lorsban, Sencor, Canopy, Atrazine, Lasso, Prowl, and Blazer** (Table 4).

Table 2. ***Coldwater system physical means for January, 1989 through June, 1991.***

Site	Parameter	Mean	Minimum	Maximum
Camp Creek Canal (Channelized)				
(7-1)	Temperature (°C)	16.5	0.7	31.0
	Conductivity (μ mhos/cm)	113	3	332
	Dissolved Oxygen (mg/L)	7.6	3.8	12.7
	pH (units)	6.3	5.4	7.1
	Total Solids (mg/L)	322	47	3827
	Dissolved Solids (mg/L)	91	15	168
	Suspended Solids (mg/L)	232	0	3780
Coldwater/Pigeon Roost (Channelized)				
(7-2)	Temperature	17.1	0.8	31.6
	Conductivity	40	4	67
	Dissolved Oxygen	8.2	5.2	13.5
	pH	6.3	5.3	7.4
	Total Solids	210	41	2657
	Dissolved Solids	52	17	136
	Suspended Solids	158	2	2607
Red Banks Creek (Channelized)				
(7-3)	Temperature	16.1	0.9	31.9
	Conductivity	53	3	119
	Dissolved Oxygen	8.5	6.4	12.4
	pH	6.3	5.5	7.3
	Total Solids	246	35	3181
	Dissolved Solids	60	32	119
	Suspended Solids	184	0	3123
Pigeon Roost @ Ingram's Mill (Channelized)				
(7-4)	Temperature	17.0	2.0	29.8
	Conductivity	39	3	118
	Dissolved Oxygen	8.4	5.7	12.7
	pH	6.3	5.4	7.3
	Total Solids	228	24	1998
	Dissolved Solids	50	6	135
	Suspended Solids	178	0	1905

Table 2. (Continued) ***Coldwater system physical means for January, 1989 through June, 1991.***

Site	Parameter	Mean	Minimum	Maximum
Coldwater @ Lewisburg (Natural channel)				
(7-5)	Temperature	16.7	0.5	30.2
	Conductivity	38	7	91
	Dissolved Oxygen	7.6	4.8	12.0
	pH	6.3	5.5	7.4
	Total Solids	138	52	606
	Dissolved Solids	53	13	113
	Suspended Solids	86	0	549
Coldwater @ Hwy 78 (Natural channel)				
(7-6)	Temperature	16.5	0.6	29.3
	Conductivity	38	5	71
	Dissolved Oxygen	7.6	4.9	11.6
	pH	6.3	5.4	7.4
	Total Solids	125	39	503
	Dissolved Solids	52	19	149
	Suspended Solids	73	0	452
Coldwater @ Red Banks (Natural channel)				
(7-7)	Temperature	16.1	2.0	26.6
	Conductivity	36	7	68
	Dissolved Oxygen	7.7	4.8	13.1
	pH	6.3	5.3	7.3
	Total Solids	112	33	914
	Dissolved Solids	49	6	204
	Suspended Solids	62	0	861
Coldwater @ Hwy 7 (Natural channel)				
(7-8)	Temperature	16.5	3.2	27.8
	Conductivity	58	2	147
	Dissolved Oxygen	6.6	2.6	13.2
	pH	6.2	5.2	7.2
	Total Solids	113	32	851
	Dissolved Solids	59	28	173
	Suspended Solids	55	0	820

Table 2. (Continued) ***Coldwater system physical means for January, 1989 through June, 1991.***

Site	Parameter	Mean	Minimum	Maximum
Pigeon Roost @ Hwy 309 (Channelized)				
(X-1)	Temperature	16.1	6.6	26.3
	Conductivity	29	4	50
	Dissolved Oxygen	8.7	7.1	12.1
	pH	5.7	5.3	6.2
	Total Solids	276	47	1391
	Dissolved Solids	64	32	162
	Suspended Solids	212	5	1259
Cuffawa Creek @ Marianna (Channelized)				
(X-2)	Temperature	16.1	5.2	29.9
	Conductivity	31	3	88
	Dissolved Oxygen	8.7	7.5	10.8
	pH	5.7	5.4	6.2
	Total Solids	285	69	1662
	Dissolved Solids	79	50	151
	Suspended Solids	206	10	1511
Pigeon Roost north of Marianna (Channelized)				
(X-3)	Temperature	15.8	7.2	25.7
	Conductivity	42	7	63
	Dissolved Oxygen	8.7	7.1	11.6
	pH	5.6	5.4	6.2
	Total Solids	218	61	929
	Dissolved Solids	73	42	166
	Suspended Solids	145	10	827
Pigeon Roost between Marianna and Holly Springs (Channelized)				
(X-4)	Temperature	12.7	5.1	21.1
	Conductivity	57	9	104
	Dissolved Oxygen	8.3	7.0	9.9
	pH	5.7	5.5	6.0
	Total Solids	256	78	989
	Dissolved Solids	134	45	636
	Suspended Solids	122	0	517

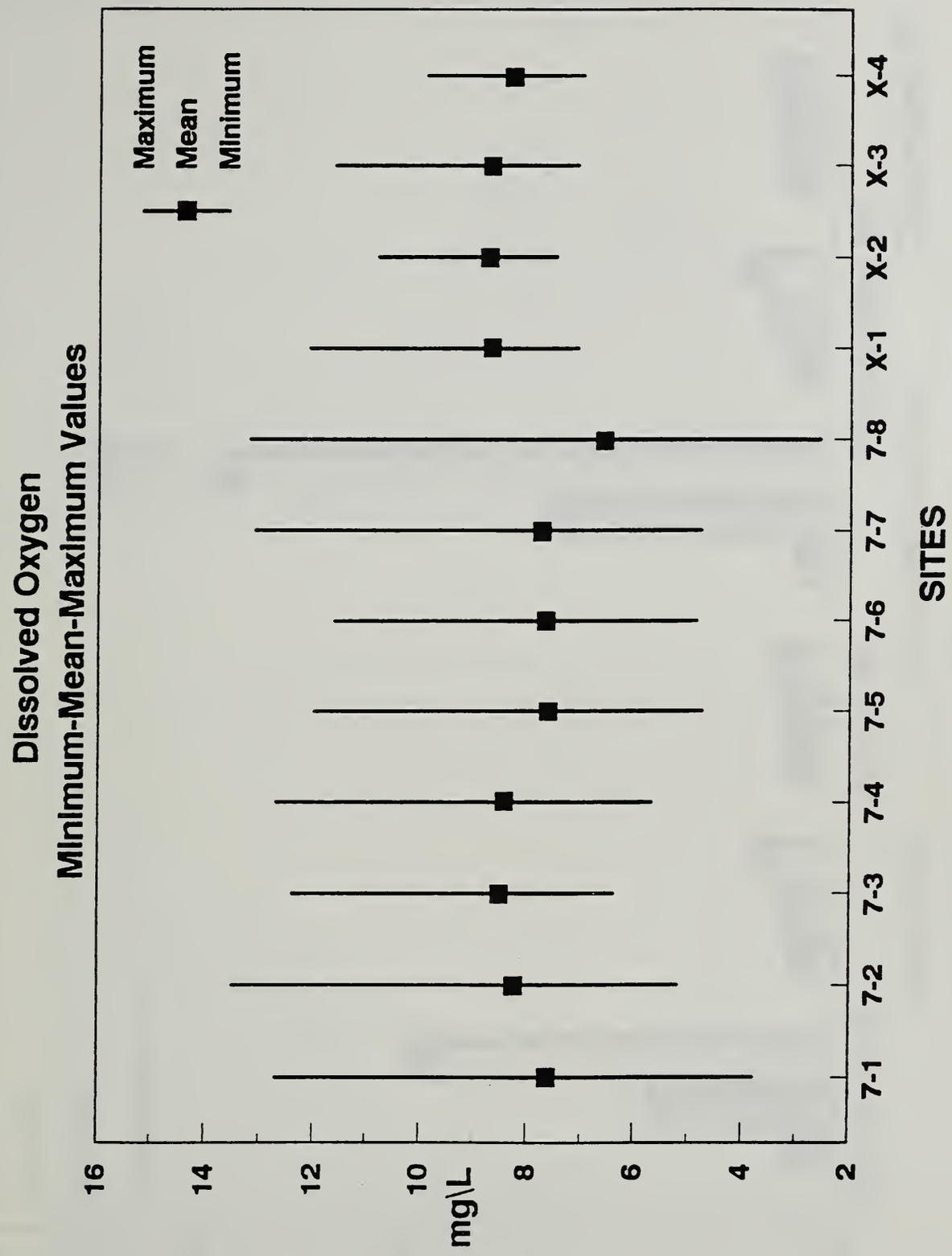
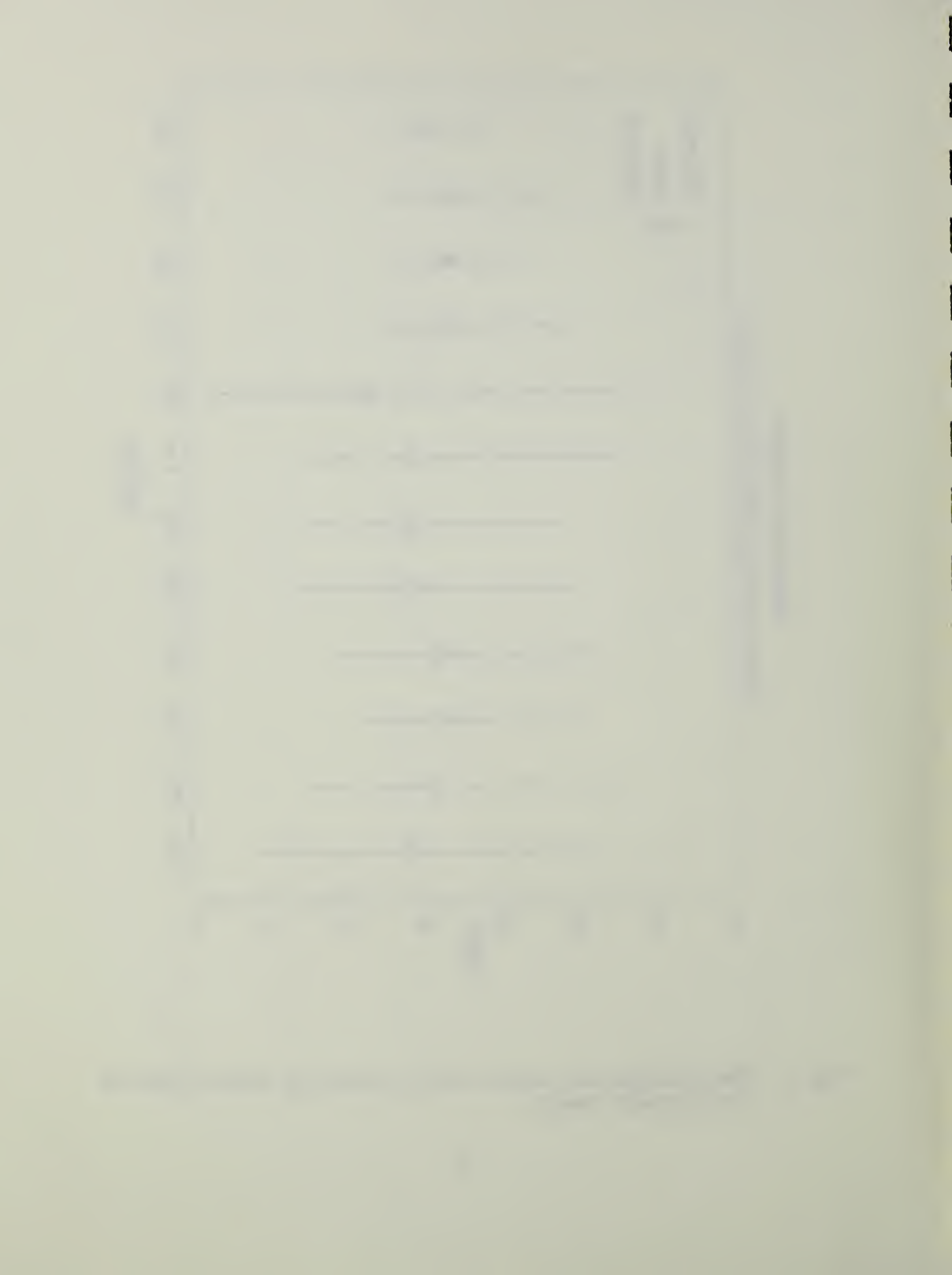


Fig. 2. Dissolved oxygen with minimum, mean, and maximum values for each site of the Coldwater drainage.



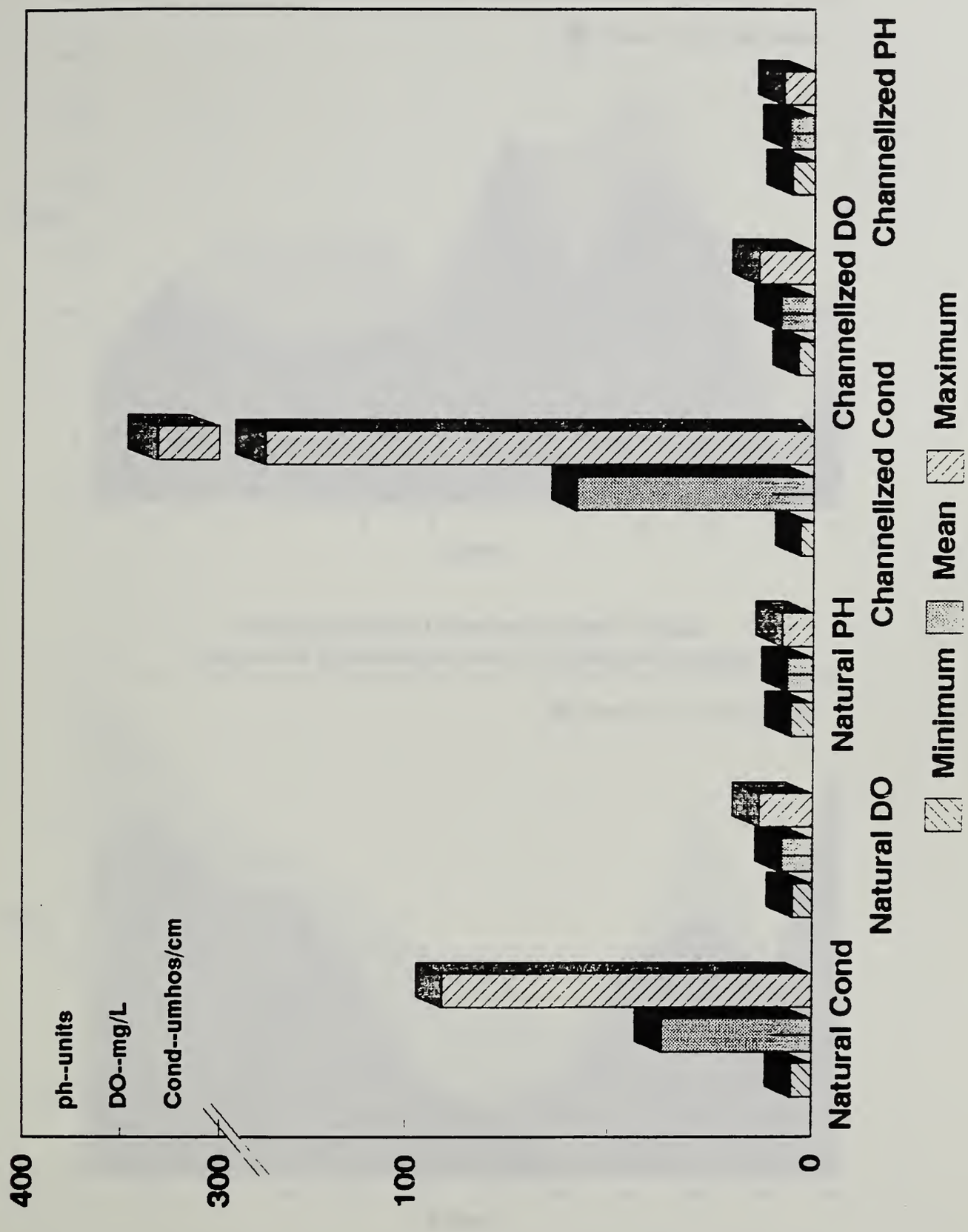
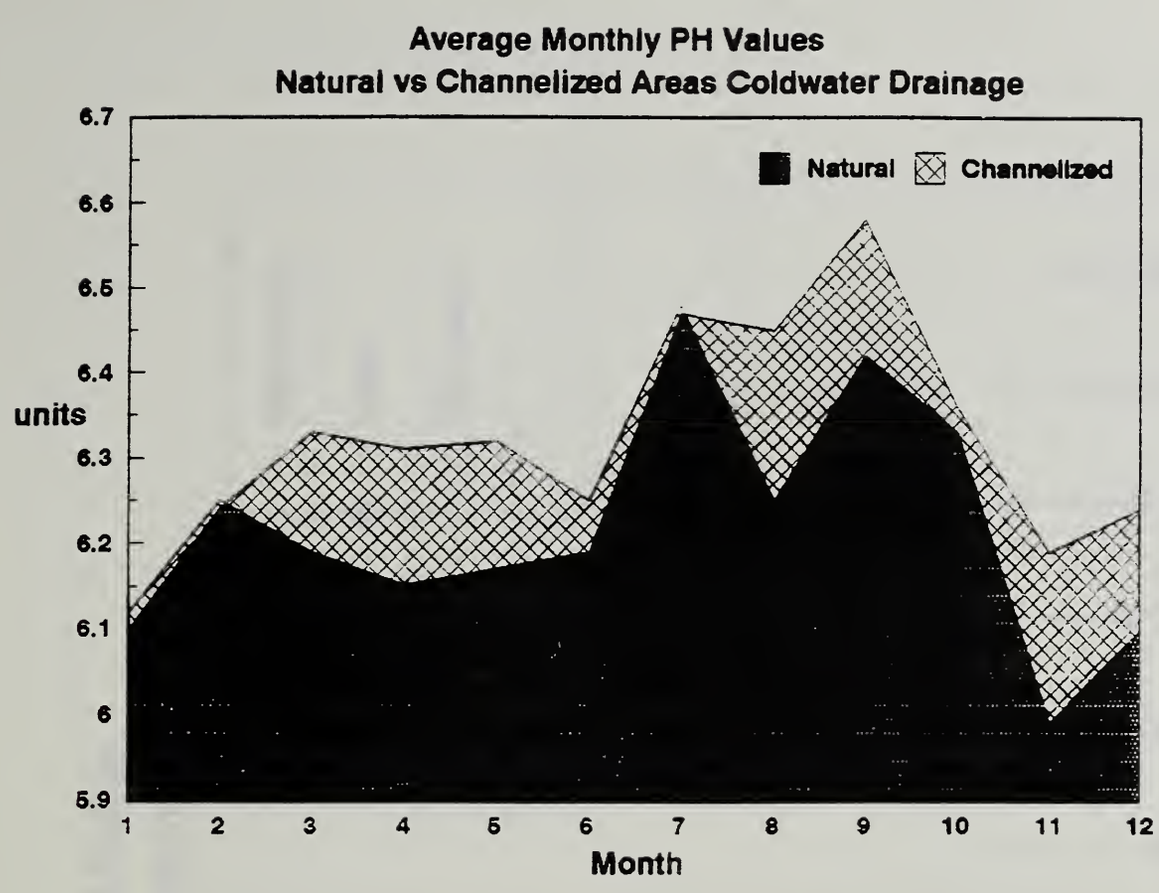


Fig. 3. Conductivity (Cond), dissolved oxygen (DO), and pH values of natural (4 sites) vs channelized (8 sites) areas of the Coldwater River drainage with minimum, mean, and maximum values.



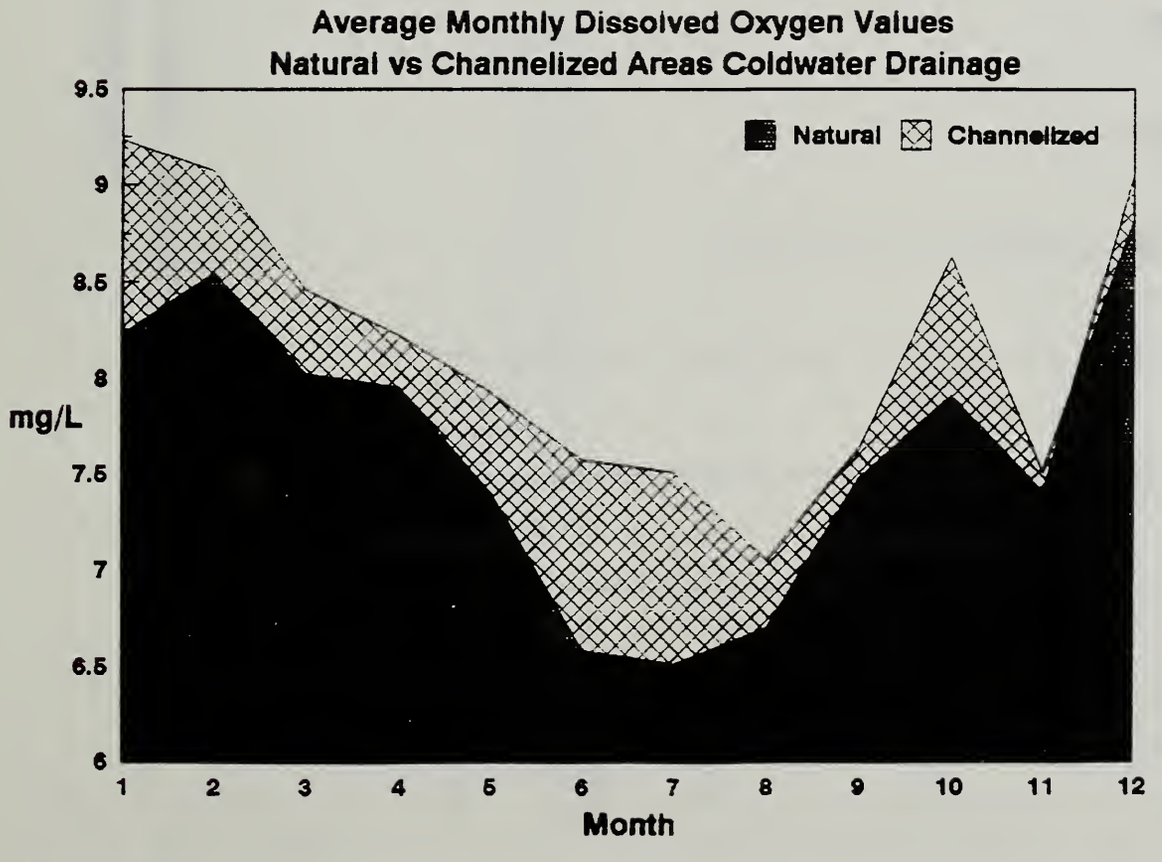
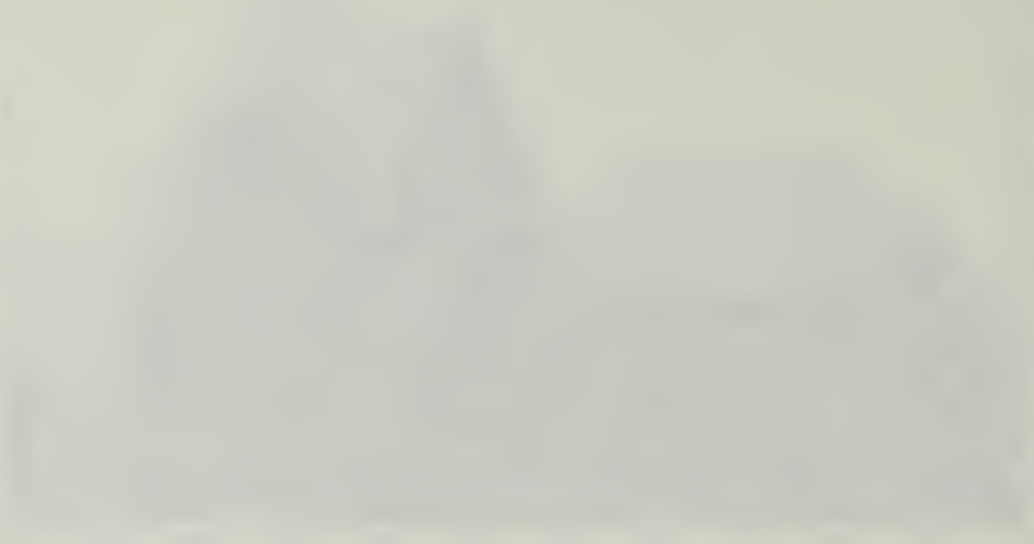


Fig. 4. Monthly mean pH and dissolved oxygen values of natural vs channelized areas of the Coldwater River drainage.



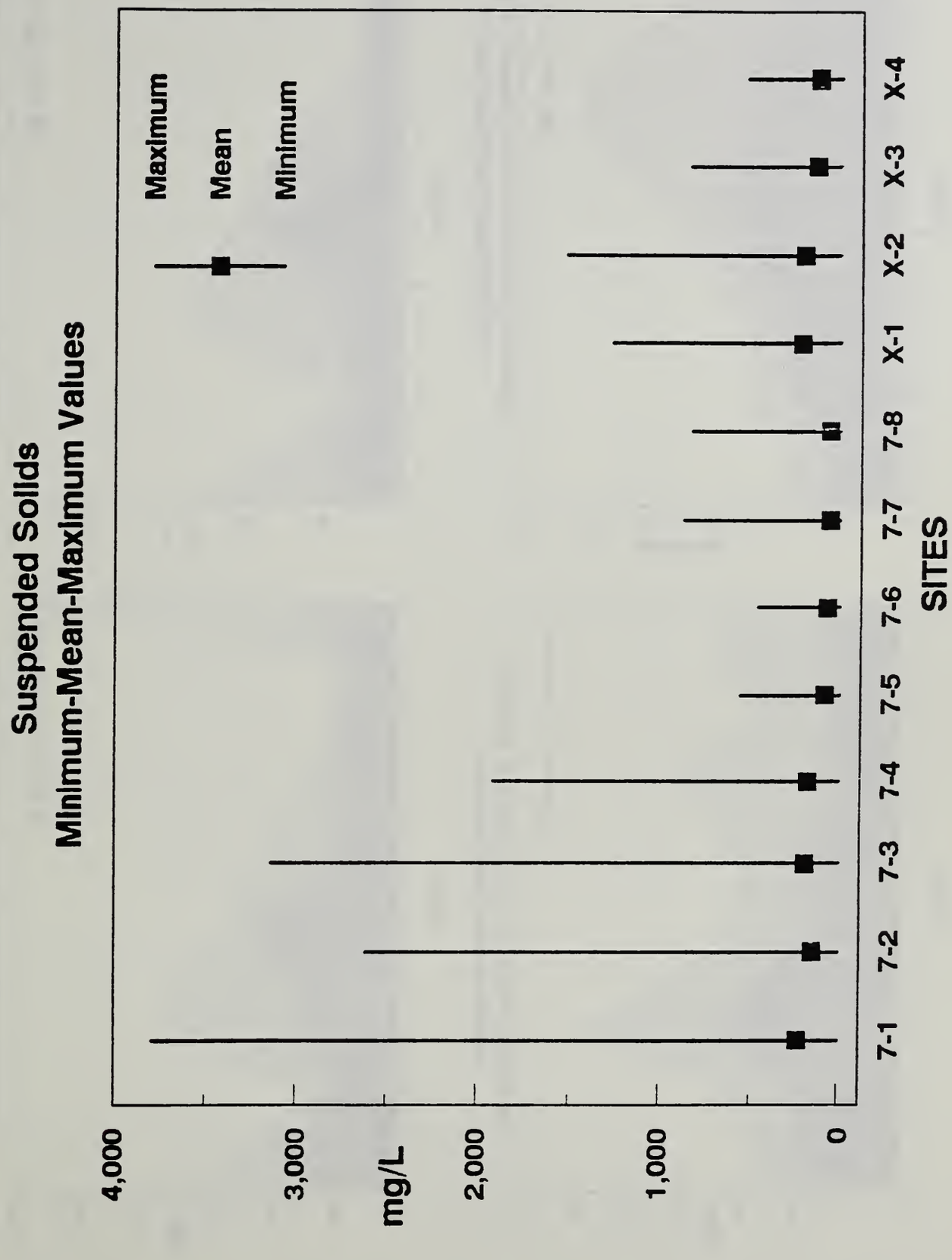


Fig. 5. Suspended sediments with minimum, mean, and maximum values for each site of the Coldwater drainage.

Fig. 6. Monthly sediment and conductivity means for natural vs channelized areas of the Coldwater River drainage.

Table 3. ***Coldwater system nutrient means for January, 1989 through June, 1991.***

Site		Nutrient	Mean	Minimum mg/L	Maximum
Camp Creek Canal (Channelized)					
(7-1)	Filterable	Ortho-Phosphorus	0.08	0.01	0.32
		Total Phosphorus	0.38	0.10	1.77
		Nitrate	0.36	0.01	1.68
		Ammonia	0.14	0.00	0.69
Coldwater/Pigeon Roost (Channelized)					
(7-2)	Filterable	Ortho-Phosphorus	0.02	0.00	0.07
		Total Phosphorus	0.22	0.05	1.29
		Nitrate	0.21	0.04	0.65
		Ammonia	0.08	0.00	0.46
Red Banks Creek (Channelized)					
(7-3)	Filterable	Ortho-Phosphorus	0.02	0.00	0.14
		Total Phosphorus	0.21	0.02	1.38
		Nitrate	0.42	0.02	1.45
		Ammonia	0.07	0.00	0.28
Pigeon Roost @ Ingram's Mill (Channelized)					
(7-4)	Filterable	Ortho-Phosphorus	0.02	0.00	0.11
		Total Phosphorus	0.21	0.03	1.53
		Nitrate	0.33	0.09	0.90
		Ammonia	0.07	0.00	0.44
Coldwater @ Lewisburg (Natural Channel)					
(7-5)	Filterable	Ortho-Phosphorus	0.01	0.00	0.05
		Total Phosphorus	0.19	0.05	0.89
		Nitrate	0.12	0.02	0.59
		Ammonia	0.08	0.00	0.77
Coldwater @ Hwy 78 (Natural Channel)					
(7-6)	Filterable	Ortho-Phosphorus	0.02	0.00	0.12
		Total Phosphorus	0.18	0.05	0.74
		Nitrate	0.13	0.01	0.82
		Ammonia	0.08	0.00	0.30

Table 3. ***Coldwater system nutrient means for January, 1989 through June, 1991.***

Site		Nutrient	Mean	Minimum mg/L	Maximum
Coldwater @ Red Banks (Natural Channel)					
(7-7)	Filterable	Ortho-Phosphorus	0.01	0.00	0.12
		Total Phosphorus	0.14	0.02	0.69
		Nitrate	0.16	0.04	0.82
		Ammonia	0.09	0.00	0.89
Coldwater @ Hwy 7 (Natural Channel)					
(7-8)	Filterable	Ortho-Phosphorus	0.01	0.00	0.03
		Total Phosphorus	0.14	0.02	0.93
		Nitrate	0.17	0.01	0.54
		Ammonia	0.09	0.00	0.44
Pigeon Roost @ Hwy 309 (Channelized)					
(X-1)	Filterable	Ortho-Phosphorus	0.02	0.01	0.04
		Total Phosphorus	0.26	0.04	0.99
		Nitrate	0.49	0.12	0.80
		Ammonia	0.09	0.00	0.22
Cuffawa Creek @ Marianna (Channelized)					
(X-2)	Filterable	Ortho-Phosphorus	0.02	0.01	0.09
		Total Phosphorus	0.33	0.03	1.68
		Nitrate	0.77	0.11	2.21
		Ammonia	0.07	0.00	0.13
Pigeon Roost north of Marianna (Channelized)					
(X-3)	Filterable	Ortho-Phosphorus	0.02	0.01	0.05
		Total Phosphorus	0.22	0.07	0.72
		Nitrate	0.67	0.02	1.21
		Ammonia	0.18	0.01	0.78
Pigeon Roost between Marianna and Holly Springs (Channelized)					
(X-4)	Filterable	Ortho-Phosphorus	0.07	0.03	0.17
		Total Phosphorus	0.40	0.18	1.04
		Nitrate	0.82	0.21	1.41
		Ammonia	0.53	0.03	1.46

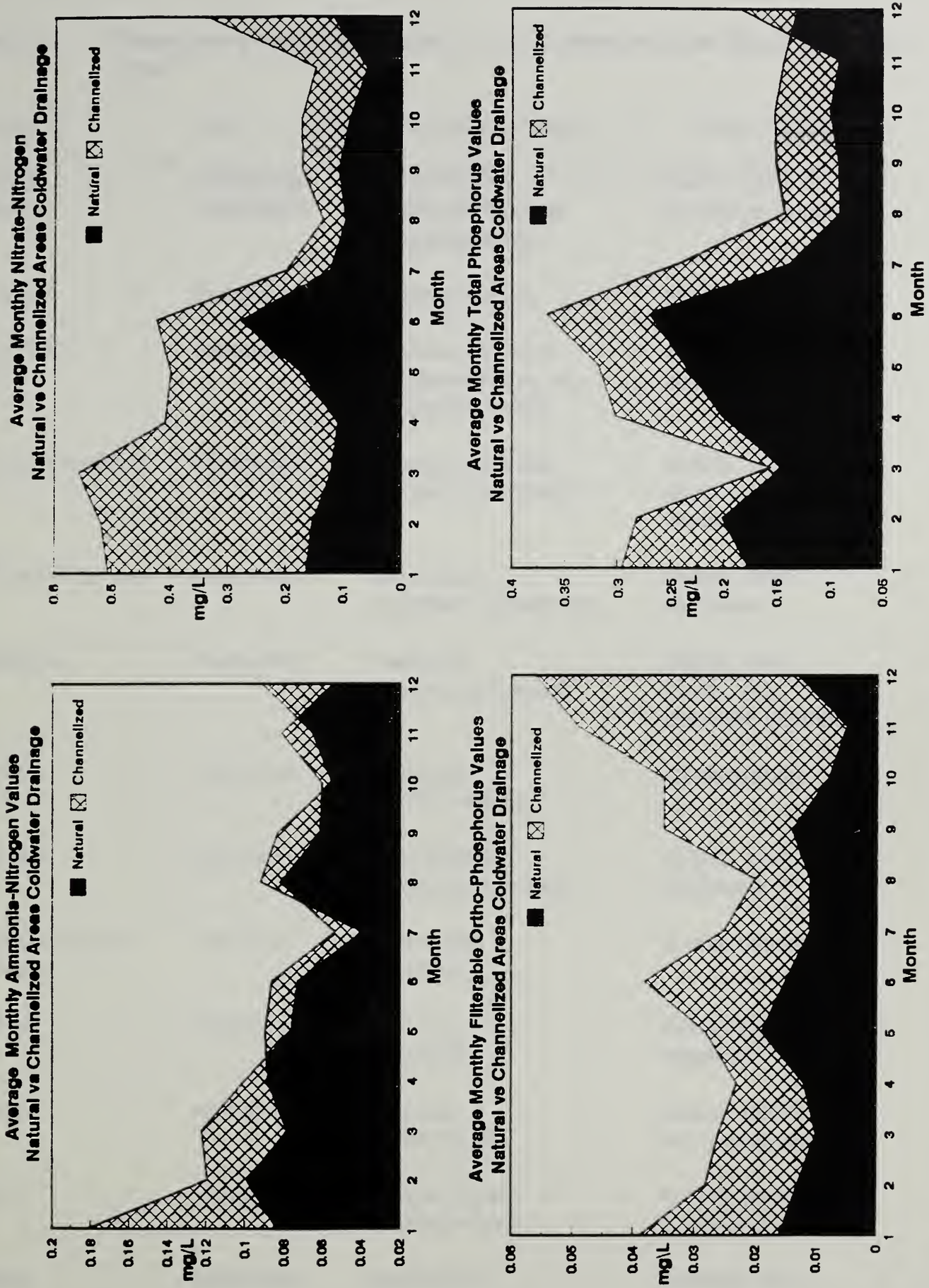


Fig. 7. Nutrient monthly means for natural vs channelized areas of the Coldwater River drainage.

Table 4. ***Pesticides commonly applied in the Coldwater River Basin and their uses.***

Pesticide[1]	Use	Chemical (Type)	Target Crops
Arsenic (MSMA)	Herbicide/ Insecticide	monosodium methanearsonate (organoarsenic)	lawns, turf, premerge cotton
Mercury	Fungicide	organomercury	seed treatment
DDT, DDD, DDE	Insecticide	Dichlorodiphenyl-trichloroethane, etc. (organochlorine)	cotton, soybeans, etc.
Methyl Parathion	Insecticide	methyl parathion (organophosphate)	cotton, corn, soybeans, rice, wheat
Ambush/Pounce	Insecticide	permethrin (synthetic pyrethroid)	cotton, corn, soybeans
Basagran	Herbicide	bentazon (benzothiadiazole)	beans, corn, lawns, rice, peanuts, soybeans
Treflan	Herbicide	trifluralin (dinitroaniline)	multipurpose
Lorsban	Insecticide	chlorpyrifos (organophosphate)	cotton, corn, soybeans
Sencor/Lexone Canopy	Herbicide	metribuzin (triazine)	lawns, wheat, etc.
AAtrex	Herbicide	atrazine (triazine)	fallowland, corn, sorghum
Lasso	Herbicide	alachlor (acetamide)	beans, peanuts, corn, soybeans
Prowl	Herbicide	pendimethalin (dinitroaniline)	cotton, peanuts, soybeans, corn
Blazer	Herbicide	acifluorfen (diphenyl ether)	peanuts, rice, soybeans

1 Use of tradenames does not constitute an endorsement of products by USDA but is for information purposes only.

Eighty-eight out of a possible 1,024 occurrences of contaminants have been observed (Table 5). **Arsenic** was predominant with 46 of the 88 occurrences. **Mercury** was found 30 times. Other occasionally recovered compounds include **Trifluralin, Sencor, Atrazine, Prowl, Lasso, Lorsban, and DDE.**

Generally, storm event samples contained higher levels of contaminants than baseflow samples at any specific site. Both the number of sites containing pesticides and the number of different pesticides found at these sites peaked in early summer because of the combination of agricultural activities and rainfall.

Coliforms.--Coliform and Enterococci testing is in the early stages and appropriate dilutions to accurately reflect changing water levels are still being developed. Thus, results are preliminary and subject to revision. Table 6 lists results from 8/5/91 through 9/16/91. Preliminary identifications include Escherichia coli, Klebsiella sp., and Enterobacter sp.

Plant Survey

Eight different transects consisting of two 100 meter reaches were selected to sample different wetland habitat types (Table 7) along the Coldwater River (Fig. 8).

Each transect was sampled at least 4 times with a total of 42 collecting trips. The 100 meter reaches were subdivided into 5 sections, with the first beginning at the midpoint of the river. The subdivisions were 0 - 5, 5 - 15, 15 - 30, 30 - 60, and 60 - 100 meters. Plant species were collected once in each subdivision, with a total of 3152 plants collected. Approximately 289 species representing 175 genera and 74 families were identified from these plants. Of the 74 families, there were 59 Dicotyledons, 11 Monocotyledons, and 5 ferns and small clubmosses. (Identifications 98% complete at this time.) All plants collected are stored at the University of Mississippi Herbarium under the direction of Dr. M. B. Huneycutt.

The most productive habitat type was bottomland hardwood, followed by open marsh. Twelve species found were listed as rare, and 15 species listed as infrequent or not listed in the state of Mississippi (Table 8). (ref. Radford, et al., 1978. Manual of the Vascular Flora of the Carolinas, 1978)

Table 5. ***Prevalent contaminants from 1990 and 1991 sampling.***

Site	Date	Contaminants present	Amount (ppb)
Camp Creek Canal	3/05/90	Arsenic	5.5
(7-1) (Channelized)	5/21/90	Arsenic	5.8
	6/04/90	Arsenic	1.5
	7/23/90	Arsenic	6.8
	7/23/90	Mercury	0.5
	10/09/90	Arsenic	7.8
	10/09/90	Trifluralin	58.0
	1/28/91	Mercury	0.6
	4/15/91	Arsenic	1.7
	4/15/91	Mercury	0.2
Coldwater/Pigeon Roost	3/05/90	ND*	ND
(7-2) (Channelized)	5/21/90	Arsenic	2.8
	6/04/90	Mercury	0.1
	6/04/90	Metribuzin	36.0
	7/23/90	Arsenic	3.4
	7/23/90	Mercury	1.0
	10/09/90	Arsenic	1.2
	10/09/90	Trifluralin	<10
	1/28/91	Arsenic	4.1
	4/15/91	Arsenic	1.6
	4/15/91	Mercury	0.4
Red Banks Creek	3/05/90	Arsenic	0.4
(7-3) (Channelized)	3/05/90	DDE	0.0
	5/21/90	ND	ND
	6/04/90	Mercury	0.1
	7/23/90	Arsenic	5.2
	7/23/90	Mercury	0.9
	10/09/90	Trifluralin	22.0
	1/28/91	Arsenic	4.8
	1/28/91	Mercury	0.2
	4/15/91	Arsenic	1.1
	4/15/91	Mercury	0.1
Pigeon Roost	3/05/90	Arsenic	5.4
(7-4) (Channelized)	5/21/90	Arsenic	8.1
	6/04/90	Mercury	0.5
	7/23/90	Arsenic	1.8
	7/23/90	Mercury	0.5
	10/09/91	ND	ND
	1/28/91	Arsenic	0.5
	1/28/91	Mercury	0.3
	4/15/91	Arsenic	1.3
	4/15/91	Mercury	0.2

* None Detected

Table 5. (Continued) ***Prevalent contaminants from 1990 and 1991 sampling.***

Site	Date	Contaminants present	Amount (ppb)
Coldwater @ Lewisburg	3/05/90	Arsenic	5.5
(7-5) (Natural Channel)	5/21/90	Arsenic	2.0
	6/04/90	Arsenic	0.3
	7/23/90	Arsenic	0.5
	7/23/90	Mercury	1.0
	10/09/90	Arsenic	6.7
	10/09/90	Atrazine	<10
	10/09/90	Trifluralin	20.0
	1/28/91	Arsenic	1.2
	1/28/91	Mercury	0.3
	4/15/91	Arsenic	1.3
	4/15/91	Mercury	0.2
Coldwater @ HWY 78	3/05/90	ND*	ND
(7-6) (Natural Channel)	5/21/90	ND	ND
	6/04/90	Arsenic	4.0
	7/23/90	Arsenic	6.4
	7/23/90	Mercury	0.2
	10/09/90	Arsenic	0.8
	10/09/90	Chlorpyrifos	<15
	1/28/91	Arsenic	1.6
	1/28/91	Mercury	0.2
	4/15/91	Arsenic	1.7
	4/15/91	Mercury	0.3
Coldwater @ Red Banks	3/05/90	ND	ND
(7-7) (Natural Channel)	5/21/90	ND	ND
	6/04/90	Arsenic	0.7
	6/04/90	Mercury	0.1
	6/04/90	Metribuzin	25.0
	7/23/90	Arsenic	0.9
	7/23/90	Mercury	0.7
	10/09/90	Arsenic	0.3
	10/09/90	Alachlor	<20
	1/28/91	Arsenic	4.8
	1/28/91	Mercury	0.3
	4/15/91	Arsenic	2.2
	4/15/91	Mercury	0.2
	4/15/91	Pendimethalin	29.0

* None Detected

Table 5. (Continued) ***Prevalent contaminants from 1990 and 1991 sampling.***

Site	Date	Contaminants present	Amount (ppb)
Coldwater @ HWY 7	3/05/90	ND*	ND
(7-8) (Natural Channel)	5/21/90	ND	ND
	6/04/90	Chlorpyrifos	50.0
	7/23/90	Arsenic	0.9
	7/23/90	Mercury	0.2
	10/09/90	ND	ND
	1/28/91	ND	ND
	4/15/91	Arsenic	2.3
	4/15/91	Mercury	0.2
Pigeon Roost (X-1)	1/28/91	Arsenic	0.1
(Channelized)	4/15/91	Arsenic	0.3
Pigeon Roost (X-2)	1/28/91	Arsenic	4.4
(Channelized)	4/15/91	Arsenic	1.5
	4/15/91	Mercury	0.2
Pigeon Roost (X-3)	1/28/91	ND	ND
(Channelized)	4/15/91	Arsenic	1.2
	4/15/91	Mercury	0.1
Pigeon Roost (X-4)	1/28/91	Arsenic	0.5
(Channelized)	1/28/91	Mercury	0.1
	4/15/91	Arsenic	1.2
	4/15/91	Mercury	0.1

* None Detected

Table 6. ***Coliform and Enterococci counts per 100 ml at sites of the Coldwater River, Mississippi.***

Site	Date	Coliforms	Enterococci
7-1	8/05/91	>2000	400
	8/19/91	>2000	1720
	9/16/91	>2000	540
7-2	8/05/91	>2000	270
	8/19/91	1120	1460
	9/16/91	1100	580
7-3	8/05/91	*NS	NS
	8/19/91	NS	NS
	9/16/91	NS	NS
7-4	8/05/91	>2000	260
	8/19/91	100	1180
	9/16/91	>2000	700
7-5	8/05/91	>2000	750
	8/19/91	1260	1260
	9/16/91	>2000	900
7-6	8/05/91	>2000	600
	8/19/91	240	1520
	9/16/91	750	>2000
7-7	8/05/91	>2000	800
	8/19/91	300	1160
	9/16/91	1300	1060
7-8	8/05/91	>2000	>2000
	8/19/91	1540	>2000
	9/16/91	>2000	1510
X-1	8/05/91	>2000	280
	8/19/91	40	240
	9/16/91	400	240
X-2	8/05/91	NS	NS
	8/19/91	NS	NS
	9/16/91	NS	NS

* NS - No Sample

Table 6. (Continued) ***Coliform and Enterococci counts per 100 ml.***

Site	Date	Coliforms	Enterococci
X-3	8/05/91	>2000	640
	8/19/91	260	1100
	9/16/91	1200	590
X-4	8/05/91	>2000	1950
	8/19/91	780	1220
	9/16/91	*NS	NS

* NS - No Sample

Table 7. ***Transects, habitat types, and total number plants collected.***

1N	Bottomland hardwood	1S	Open marsh	352
2N	Bottomland hardwood	2S	Swamp/marsh	284
3N	Open marsh	3S	Open marsh	250
4N	Bottomland hardwood	4S	Bottomland hardwood	406
5N	Bottomland hardwood	5S	Bottomland hardwood	519
6N	Bottomland hardwood	6S	Swamp-bottomland hardwood-field	632
7E	Bottomland hardwood	7W	Bottomland hardwood-open marsh	314
8E	Bottomland hardwood to wet meadow	8W	Bottomland hardwood	395

NOTE: Both sides of transect 8 traverse a large levee.

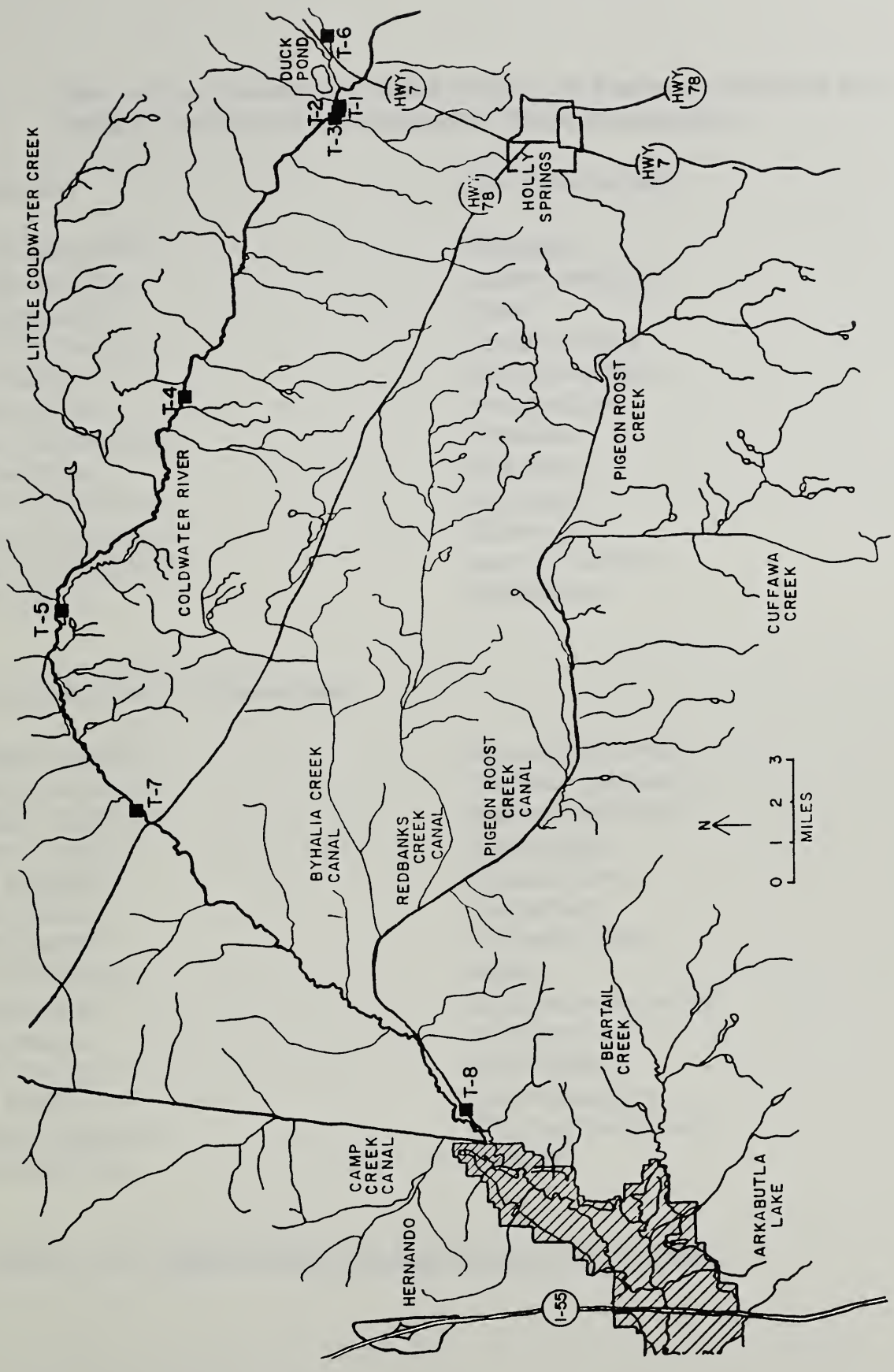


Fig. 8. Plant transect sampling sites.

Table 8. ***Rare and uncommon/unlisted species of plants collected in the wetland corridor of the Coldwater River, Mississippi.****

Rare Species	Common Names
Verbesina alternifolia	Verbesina
Brunnichia cirrhosa	Ladies'-eardrops
Carex triangularis	Carex
Cirsium carolineanus	Carolina thistle
Krigia dandelion	Dwarf dandelion
Ludwigia repens	Water willow
Peltandra sagittaefolia	Peltandra
Phlox divaricata	Blue phlox
Ranunculus abortivus	Buttercup
Ranunculus laxicaulus	Buttercup
Sagittaria montevidensis	Giant arrowleaf
Solanum nigrum	Nightshade

Uncommon/unlisted in Mississippi

Arabidopsis thaliana	Mouse-ear cress
Botrychium dissectum	Common grapefern
Botrychium virginiana	Rattlesnake fern
Cardamine hirsuta	Bitter cress
Catalpa speciosa	Catawba tree
Chelone glabra	Turtlehead
Diosceria batatas	Cinnamon vine
Geum canadensis	Avens
Habernaria flava	Southern rein-orchid
Lactuca biennis	Wild lettuce
Lactuca floridana	Wild lettuce
Pluchia foetida	Marsh-fleabane
Polygonum scandens	Climbing buckwheat
Scirpus atrovirens	Bulrush

* Radford, et al. Manual of the Vascular Flora of the Carolinas.

Fauna Surveys

Fish collections from 8 sites on the Coldwater and its tributaries included representatives of 37 species of fish (Table 9). No species collected is included on the state or federal lists of threatened, endangered or of special concern species; and all species have been previously collected in other DEC Watersheds. The unaltered central corridor of the Coldwater River produced a greater diversity of fish than the channelized tributary Pigeon Roost (Tables 10-15). An average of 19 species were identified from collections in the unaltered central corridor of the Coldwater River and only 6 species have been identified from Pigeon Roost. Average catch per unit of effort was 1.12 kg/m which was lower than the 3.77 kg/m from Hotophia Creek, another DEC stream. This is probably because of decreased sampling efficiency associated with the deep water and braided conditions of the Coldwater system rather than lower productivity. Further sampling will be required before reliable catch per effort data and comprehensive species lists can be developed.

Chlorophyll

Chlorophyll measurements are reflective of primary productivity in surface waters. Stream chlorophyll is regulated by nutrients, shading, and distance of travel in flowing water. Average monthly chlorophyll concentrations in the Coldwater River Basin reflected habitat and nutrient conditions in natural and channelized stream sections (Fig. 9). Channelized tributaries with little or no shading and greater nutrient concentrations consistently had greater chlorophyll concentrations. Though these sites indicated a trend toward eutrophication, no sites were actually eutrophic.

Status of Project

Several phases of this project on the Coldwater River will continue thru 1992. Water Quality sampling will be done routinely as will fisheries studies. Additional statistical procedures will include analyzing for significant differences between sub-watersheds. Sediment cores will be collected for particle size distribution, total organic carbon, and contaminants.

LITERATURE CITED

APHA. 1989. Standard methods for the examination of water and wastewater. 17th Edition. American Public Health Association, Washington, DC. Port City Press, Baltimore, MA.

Nielsen, Larry A. and David L. Johnson. 1983. Fisheries Techniques. American Fisheries Society, Bethesda, MD. 468 pp.

Radford, Albert E., Ahles, Harry E. and Bell, C. Ritchie. 1978. Manual of the vascular flora of the Carolinas. The University of North Carolina Press, Chapel Hill, NC. 1183 pp.

Gehrig, Connie C. and Timothy M. Fitzpatrick. 1989. J. Assoc. Office Anal. Chem. 72:994-996.

Holak, Walter. 1989. J. Assoc. Off. Anal. Chem. 72:926-930.

Smith, S. and G. H. Willis. 1987 Interaction of methyl parathion with permethrin and flucythrinate as related to their mutual persistence in soil. Soil Sci. 144:67-71.

U. S. Environmental Protection Agency. 1971. Methods of organic pesticides in water and wastewater. National Environmental Research Center, Cincinnati, OH. 59 pp.

Table 9. ***Comprehensive list to date of fishes collected from Coldwater River and its Tributaries.***

Species

Amia calva
Aphredoderus sayanus
Carpiodes carpio
Cyprinus carpio
Dorosoma cepedianum
Elassoma zonatum
Erimyzon oblongus
Esox americanus
Etheostoma swaini
Etheostoma whipplei
Etheostoma histrio
Fundulus notatus
Fundulus olivaceus
Gambusia affinis
Ictalurus melas
Ictalurus natalis
Ictalurus punctatus
Ictiobus niger
Labidesthes sicculus
Lepisosteus oculatus
Lepomis cyanellus
Lepomis gulosus
Lepomis megalotis
Lepomis macrochirus
Micropterus punctulatus
Micropterus salmoides
Moxostoma poecilurum
Notropis atherinoides
Notropis camurus
Notropis umbratilis
Nortopis venustus
Noturus phaeus
Noturus miurus
Percina sciera
Pimephales notatus
Pomoxis niger
Pylodictis olivaris

Table 10. ***List of fish species from Coldwater River east of Hwy 7.***

Species

Elassoma zonatum
Erimyzon oblongus
Esox americanus
Etheostoma swaini
Fundulus notatus
Fundulus olivaceus
Gambusia affinis
Ictalurus natalis
Lepomis cyanellus
Lepomis gulosus
Lepomis megalotis
Lepomis macrochirus
Notropis umbratilis
Noturus phaeus
Pimephales notatus

Table 11. ***Fish species from Coldwater River west of Hwy 7 near the Duck Pond.***

Species

Amia calva
Dorosoma cepedianum
Elassoma zonatum
Erimyzon oblongus
Etheostoma swaini
Fundulus olivaceus
Gambusia affinis
Ictalurus melas
Ictalurus natalis
Lepisosteus oculatus
Lepomis megalotis
Lepomis macrochirus
Micropterus punctulatus
Notropis camurus
Notropis umbratilis
Noturus phaeus
Percina sciera
Pimephales notatus

Table 12. ***List of fish species from Coldwater River north of Red Banks.***

Species

Aphredoderus sayanus
Carpiodes carpio
Cyprinus carpio
Dorosoma cepedianum
Elassoma zonatum
Etheostoma swaini
Etheostoma whipplei
Fundulus olivaceus
Ictalurus melas
Ictalurus natalis
Ictalurus punctatus
Ictiobus niger
Lepisosteus oculatus
Lepomis cyanellus
Lepomis gulosus
Lepomis megalotis
Lepomis macrochirus
Notropis camurus
Notropis umbratilis
Noturus phaeus
Noturus miurus
Percina sciera
Pimephales notatus
Pylodictis olivaris

Table 13. ***List of fish species from Coldwater River north of Byhalia.***

Species

Amia calva
Aphredoderus sayanus
Carpiodes carpio
Cyprinus carpio
Dorosoma cepedianum
Elassoma zonatum
Etheostoma swaini
Etheostoma whipplei
Etheostoma histrio
Fundulus olivaceus
Gambusia affinis
Ictalurus natalis
Lepisosteus oculatus
Lepomis macrochirus
Notropis camurus
Notropis umbratilis
Noturus phaeus
Noturus miurus
Percina sciera
Pomoxis niger

Table 14. ***List of fish species from Coldwater at Hwy 78.***

Species

Carpiodes carpio
Cyprinus carpio
Dorosoma cepedianum
Fundulus olivaceus
Ictalurus natalis
Ictalurus punctatus
Labidesthes sicculus
Lepisosteus oculatus
Lepomis gulosus
Lepomis macrochirus
Micropterus salmoides
Moxostoma poecilurum
Notropis atherinoides
Nortopis venustus
Pimephales notatus
Pomoxis niger

Table 15. ***List of fish species from Pigeon Roost south of Byhalia.***

Species

Fundulus olivaceus
Ictalurus punctatus
Lepomis megalotis
Lepomis macrochirus
Notropis camurus
Pimephales notatus

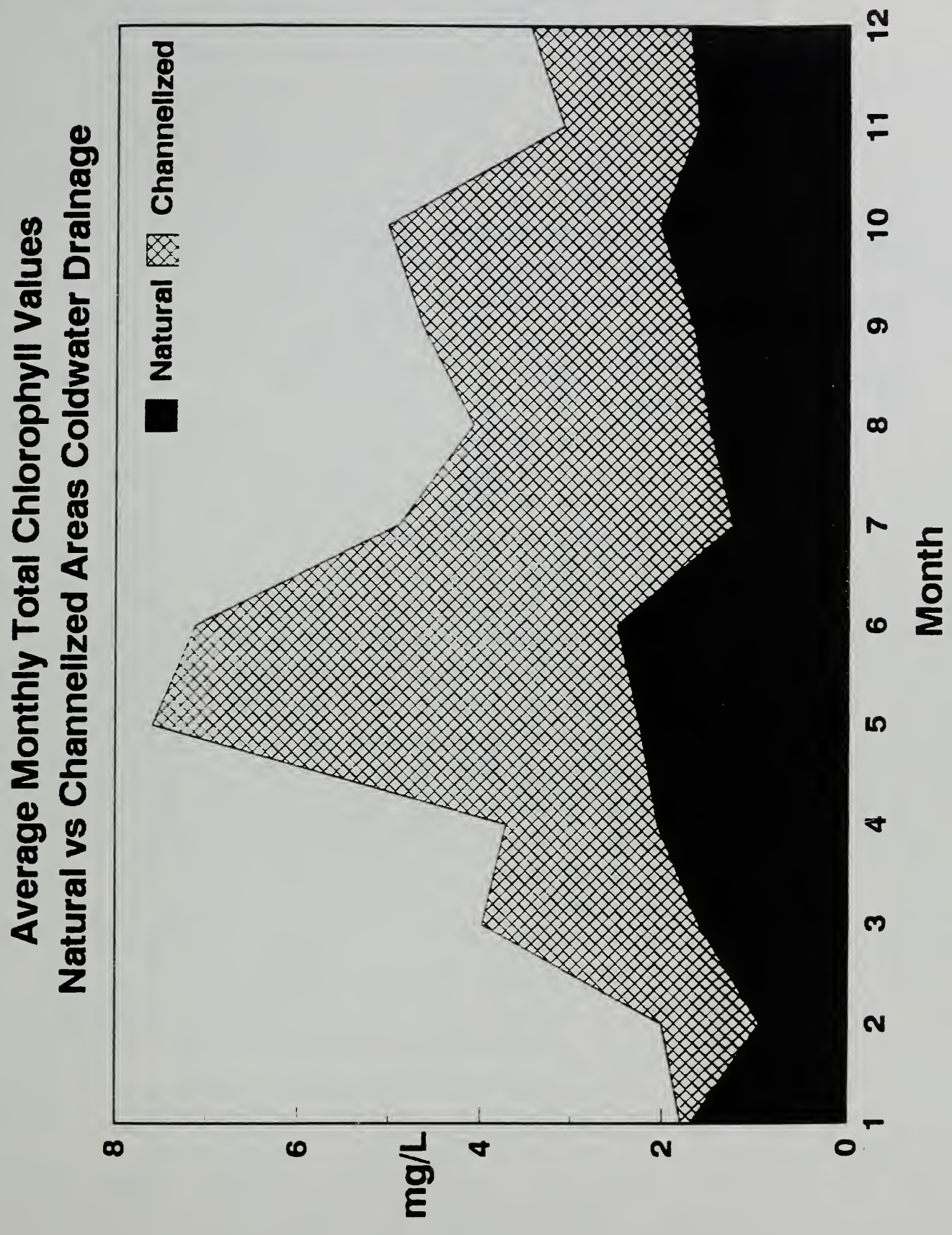


Fig. 9. Mean total chlorophyll values by month for natural vs channelized areas of the Coldwater River drainage.